## REMARKS

The Office Action mailed November 5, 2007, and made final, has been carefully reviewed and the foregoing amendment has been made in consequence thereof.

Claims 1-25 are now pending in this application. Claims 1-3, 15-17, and 19-25 stand rejected. Claims 4-14 and 18 stand objected to.

The Examiner indicated that Claims 4-14 and 18 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The rejection of Claims 1-3, 15-17, and 19-25 under 35 U.S.C. § 103(a) as being unpatentable over Yavuz et al. (U.S. Pat. No. 6,539,074) ("the '074 Patent") in view of Yavuz et al. (U.S. Pat. No. 6,522,712) ("the '712 Patent") is respectfully traversed.

The '074 Patent describes a tomographic image generation method. The method includes acquiring projection data from different data acquisition cycles. More specifically, a helical scan is used to acquire the projection data. Projection views within the projection data are grouped into sets that each include a plurality of projection views at one view angle and at a plurality of successive positions on a Z-axis. For each set of projection views, the corresponding view angle is different from the corresponding view angle of the projection views of each of the other sets of projection views. As such, each set of projection views is at a different view angle. Further, the sets are selected based on a time delay (TD) after an R-wave of an electrocardiogram (EKG) signal such that the sets represent the same phase of a cardiac cycle. Accordingly, in the method of the '074 Patent, the projection views are not grouped such that each set includes only projection views at a single Z-location.

The method also includes reconstructing a slice image of the object at a specified position on the Z-axis based on a plurality of projection views selected from respective ones of the sets of projection views. More specifically, an operation (1240) specifies the axial positions ($z_i$) at which a slice image is to be reconstructed. Another operation (1250) then reconciles axial positions within selected projection data sets with the specified axial position ($z_i$) for the slice image to be reconstructed using interpolation, if needed. As such, a image is reconstructed at the specified Z-location at a plurality of view angles by using projection views from a plurality of the sets. To generate a three-dimensional image, a series of two-

dimensional images are each reconstructed at a successive Z-location to form a "stack" of images. Notably, the '074 Patent does not describe or suggest acquiring images at multiple z-locations $z_1 \ldots z_n$ and at different times $t_1 \ldots t_n$ at each of the z-locations to obtain a plurality of acquired image sets, *each acquired image set including only the images acquired at a single one of the z-locations*. (Emphasis added.) Further, and as acknowledged by the Examiner on pages 3 and 5 of the Office Action, the '074 Patent does not describe or suggest reordering CT images within at least one acquired image set to obtain at least one synchronized image set.

The '712 Patent describes a tomographic image generation method that includes determining a plurality of working projection views of an object at a selected view angle based on initial projection data ([θ(n), Z(m)]) that was collected in respective different data acquisition cycles, and interpolating between the working projection views to generate an interpolated projection view of the object at the selected view angle. The initial projection data ([θ(n), Z(m)]) is acquired during a helical scan. The projection data is re-ordered by analyzing (3702) the data to determine a particular set of projection views at a selected view angle for each data acquisition cycle. An operation (3730) provides a reconciliation, such as z-interpolation, between axial positions at which the projection views of a particular set represent the object and the axial positions at which stacked slice images are to represent the object. After reconciliation (3730), an operation (3740) reconstructs slice images at the respective specified axial positions. Notably, the '712 Patent does not describe or suggest acquiring images at multiple z-locations $z_1 \ldots z_n$ and at different times $t_1 \ldots t_n$ at each of the z-locations to obtain a plurality of acquired image sets, *each acquired image set including only the images acquired at a single one of the z-locations*. (Emphasis added.) Further, and in contrast to the Examiner's assertions on pages 3 and 4-5 of the Office Action, the '712 Patent does not describe or suggest reordering the images within at least one of the acquired image sets to obtain at least one synchronized image set.

Claim 1 recites a method for retrospective internal gating comprising "acquiring images at multiple z-locations $z_1 \ldots z_n$ and at different times $t_1 \ldots t_n$ at each of the z-locations to obtain a plurality of acquired image sets, each acquired image set including only the images acquired at a single one of the z-locations . . . and reordering the images within at least one of the acquired image sets to obtain at least one synchronized image set that includes at least

two images that appear to have been acquired contemporaneously, each synchronized image set including only the images acquired at a single one of the z-locations."

Neither the '074 Patent nor the '712 Patent, considered alone or in combination, describes or suggests a method for retrospective internal gating as recited in Claim 1. More specifically, neither the '074 Patent nor the '712 Patent, considered alone or in combination, describes or suggests a method that includes acquiring images at multiple z-locations $z_1 \ldots z_n$ and at different times $t_1 \ldots t_n$ at each of the z-locations to obtain a plurality of acquired image sets, *each acquired image set including only the images acquired at a single one of the z-locations* (emphasis added). Rather, in contrast to the present invention, the '074 Patent describes regrouping projection views within projection data into sets that each include a plurality of projection views at one view angle and *at a plurality of successive positions on a Z-axis*, and the '712 Patent describes re-ordering projection data by analyzing the projection data to determine a particular set of projection views *at a selected view angle* for each data acquisition cycle.

Further, neither the '074 Patent nor the '712 Patent, considered alone or in combination, describes or suggests a method that includes reordering images within at least one acquired image set to obtain at least one synchronized image set that includes at least two images that appear to have been acquired contemporaneously, each synchronized image set including only the images acquired at a single one of the z-locations. Rather, in contrast to the present invention, the '074 Patent describes reconstructing a slice image of an object at a specified position on the Z-axis based on a plurality of projection views selected from respective ones of the sets of projection views, and the '712 Patent describes reconciling such axial positions at which projection views of a particular set represent an object with axial positions at which stacked slice images are to represent the object.

Accordingly, for at least the reasons set forth above, Claim 1 is submitted to be patentable over the '074 Patent in view of the '712 Patent.

Claims 2, 3, 15-17, and 19-21 depend, directly or indirectly, from independent Claim 1. When the recitations of Claims 2, 3, 15-17, and 19-21 are considered in combination with the recitations of Claim 1, Applicants submit that dependent Claims 2, 3, 15-17, and 19-21 likewise are patentable over the '074 Patent in view of the '712 Patent.

Claim 22 recites a computer-readable medium encoded with a program configured to "acquire images at multiple z-locations $z_1 \ldots z_n$ and at different times $t_1 \ldots t_n$ at each of the z-locations to obtain a plurality of acquired image sets, each acquired image set including only the images acquired at a single one of the z-locations . . . extract motion information from the images by using temporal data acquired at different times $t_1 \ldots t_n$ at each of the z-locations and using a mean intensity value of at least a portion of one of the images . . . and reorder the images within at least one of the acquired image sets to obtain at least one synchronized image set, each synchronized image set including only the images acquired at a single one of the z-locations."

Neither the '074 Patent nor the '712 Patent, considered alone or in combination, describes or suggests a computer-readable medium as recited in Claim 22. More specifically, neither the '074 Patent nor the '712 Patent, considered alone or in combination, describes or suggests a computer-readable medium encoded with a program configured to acquire images at multiple z-locations $z_1 \ldots z_n$ and at different times $t_1 \ldots t_n$ at each of the z-locations to obtain a plurality of acquired image sets, *each acquired image set including only the images acquired at a single one of the z-locations* (emphasis added). Rather, in contrast to the present invention, the '074 Patent describes regrouping projection views within projection data into sets that each include a plurality of projection views at one view angle and *at a plurality of successive positions on a Z-axis*, and the '712 Patent describes re-ordering projection data by analyzing the projection data to determine a particular set of projection views *at a selected view angle* for each data acquisition cycle.

Further, neither the '074 Patent nor the '712 Patent, considered alone or in combination, describes or suggests a computer-readable medium encoded with a program configured to extract motion information from the images by using temporal data acquired at different times $t_1 \ldots t_n$ at each of the z-locations and using a mean intensity value of at least a portion of one of the images. Rather, in contrast to the present invention, the '074 Patent describes using a time delay determined from an EKG signal to group projection data into sets, and the '712 Patent describes re-ordering projection data by analyzing the projection data to determine a particular set of projection views *at a selected view angle* for each data acquisition cycle.

Moreover, neither the '074 Patent nor the '712 Patent, considered alone or in combination, describes or suggests a computer-readable medium encoded with a program

configured to reorder images within at least one acquired image set to obtain at least one synchronized image set that includes at least two images that appear to have been acquired contemporaneously, each synchronized image set including only the images acquired at a single one of the z-locations. Rather, in contrast to the present invention, the '074 Patent describes reconstructing a slice image of an object at a specified position on the Z-axis based on a plurality of projection views selected from respective ones of the sets of projection views, and the '712 Patent describes reconciling such axial positions at which projection views of a particular set represent an object with axial positions at which stacked slice images are to represent the object.

Accordingly, for at least the reasons set forth above, Claim 22 is submitted to be patentable over the '074 Patent in view of the '712 Patent.

Claim 23 recites a computer configured to "acquire images at multiple z-locations $z_1 \ldots z_n$ and at different times $t_1 \ldots t_n$ at each of the z-locations to obtain a plurality of acquired image sets, each acquired image set including only the images acquired at a single one of the z-locations . . . designate one of the images in a temporal sequence $t_1 \ldots t_n$ at one of the z-locations as a reference image . . . determine a closest image in which motion of an organ is minimal with respect to a position of the organ in the reference image, the closest image being an image in the temporal sequence $t_1 \ldots t_n$ at a z-location adjacent the z-location of the reference image . . . and reorder the images within at least one of the acquired image sets to obtain at least one synchronized image set, each synchronized image set including only the images acquired at a single one of the z-locations."

Neither the '074 Patent nor the '712 Patent, considered alone or in combination, describes or suggests a computer as recited in Claim 23. More specifically, neither the '074 Patent nor the '712 Patent, considered alone or in combination, describes or suggests a computer configured to acquire images at multiple z-locations $z_1 \ldots z_n$ and at different times $t_1 \ldots t_n$ at each of the z-locations to obtain a plurality of acquired image sets, *each acquired image set including only the images acquired at a single one of the z-locations* (emphasis added). Rather, in contrast to the present invention, the '074 Patent describes regrouping projection views within projection data into sets that each include a plurality of projection views at one view angle and *at a plurality of successive positions on a Z-axis*, and the '712 Patent describes re-ordering projection data by analyzing the projection data to determine a particular set of projection views *at a selected view angle* for each data acquisition cycle.

Further, neither the '074 Patent nor the '712 Patent, considered alone or in combination, describes or suggests a computer configured to designate an image in a temporal sequence $t_1 \ldots t_n$ at a z-locations as a reference image. Rather, in contrast to the present invention, the '074 Patent describes selecting a view angle and grouping projection views in a set according the selected view angle, and the '712 Patent describes re-ordering projection data by analyzing the projection data to determine a particular set of projection views *at a selected view angle* for each data acquisition cycle.

Moreover, either the '074 Patent nor the '712 Patent, considered alone or in combination, describes or suggests a computer configured to determine a closest image in which motion of an organ is minimal with respect to a position of the organ in a reference image, the closest image being an image in the temporal sequence $t_1 \ldots t_n$ at a z-location adjacent a z-location of the reference image. Rather, in contrast to the present invention, the '074 Patent describes selecting a Z-location at which to reconstruct an image and choosing projections views from each set that correspond to the selected Z-location, and the '712 Patent describes re-ordering projection data by analyzing the projection data to determine a particular set of projection views *at a selected view angle* for each data acquisition cycle.

Additionally, neither the '074 Patent nor the '712 Patent, considered alone or in combination, describes or suggests a computer configured to reorder images within at least one acquired image set to obtain at least one synchronized image set that includes at least two images that appear to have been acquired contemporaneously, each synchronized image set including only the images acquired at a single one of the z-locations. Rather, in contrast to the present invention, the '074 Patent describes reconstructing a slice image of an object at a specified position on the Z-axis based on a plurality of projection views selected from respective ones of the sets of projection views, and the '712 Patent describes reconciling such axial positions at which projection views of a particular set represent an object with axial positions at which stacked slice images are to represent the object.

Accordingly, for at least the reasons set forth above, Claim 23 is submitted to be patentable over the '074 Patent in view of the '712 Patent.

Claim 24 recites an imaging system comprising "a scanner configured to generate attenuation data by scanning an object . . . and a controller electrically coupled to the scanner, the controller configured to . . . acquire images at multiple z-locations $z_1 \ldots z_n$ and at different

times $t_1 \ldots t_n$ at each of the z-locations to obtain a plurality of acquired image sets, each acquired image set including only the images acquired at a single one of the z-locations . . . and reorder the images within at least one of the acquired image sets to obtain at least one synchronized image set that includes at least two images that appear to have been acquired contemporaneously, each synchronized image set including only the images acquired at a single one of the z-locations."

Neither the '074 Patent nor the '712 Patent, considered alone or in combination, describes or suggests an imaging system as recited in Claim 24. More specifically, neither the '074 Patent nor the '712 Patent, considered alone or in combination, describes or suggests an imaging system that includes a controller configured to acquire images at multiple z-locations $z_1 \ldots z_n$ and at different times $t_1 \ldots t_n$ at each of the z-locations to obtain a plurality of acquired image sets, *each acquired image set including only the images acquired at a single one of the z-locations* (emphasis added). Rather, in contrast to the present invention, the '074 Patent describes regrouping projection views within projection data into sets that each include a plurality of projection views at one view angle and *at a plurality of successive positions on a Z-axis*, and the '712 Patent describes re-ordering projection data by analyzing the projection data to determine a particular set of projection views *at a selected view angle* for each data acquisition cycle.

Further, neither the '074 Patent nor the '712 Patent, considered alone or in combination, describes or suggests an imaging system that includes a controller configured to reorder images within at least one acquired image set to obtain at least one synchronized image set that includes at least two images that appear to have been acquired contemporaneously, each synchronized image set including only the images acquired at a single one of the z-locations. Rather, in contrast to the present invention, the '074 Patent describes reconstructing a slice image of an object at a specified position on the Z-axis based on a plurality of projection views selected from respective ones of the sets of projection views, and the '712 Patent describes reconciling such axial positions at which projection views of a particular set represent an object with axial positions at which stacked slice images are to represent the object.

Accordingly, for at least the reasons set forth above, Claim 24 is submitted to be patentable over the '074 Patent in view of the '712 Patent.

Claim 25 recites a computed tomography (CT) imaging system comprising "a radiation source . . . a radiation detector . . . and a computer electrically coupled to the source and the detector, the computer configured to . . . acquire CT images at multiple z-locations $z_1 \ldots z_n$ and at different times $t_1 \ldots t_n$ at each of the z-locations to obtain a plurality of acquired image sets, each acquired image set including only the CT images acquired at a single one of the z-location . . . and reorder the CT images within at least one of the acquired image sets to obtain at least one synchronized image set that includes at least two images that appear to have been acquired contemporaneously, each synchronized image set including only the CT images acquired at a single one of the z-locations."

Neither the '074 Patent nor the '712 Patent, considered alone or in combination, describes or suggests a computed tomography imaging system as recited in Claim 25. More specifically, neither the '074 Patent nor the '712 Patent, considered alone or in combination, describes or suggests a computed tomography imaging system that includes a computer configured to acquire images at multiple z-locations $z_1 \ldots z_n$ and at different times $t_1 \ldots t_n$ at each of the z-locations to obtain a plurality of acquired image sets, *each acquired image set including only the images acquired at a single one of the z-locations* (emphasis added). Rather, in contrast to the present invention, the '074 Patent describes regrouping projection views within projection data into sets that each include a plurality of projection views at one view angle and *at a plurality of successive positions on a Z-axis*, and the '712 Patent describes re-ordering projection data by analyzing the projection data to determine a particular set of projection views *at a selected view angle* for each data acquisition cycle.

Further, neither the '074 Patent nor the '712 Patent, considered alone or in combination, describes or suggests a computed tomography imaging system that includes a computer configured to reorder images within at least one acquired image set to obtain at least one synchronized image set that includes at least two images that appear to have been acquired contemporaneously, each synchronized image set including only the images acquired at a single one of the z-locations. Rather, in contrast to the present invention, the '074 Patent describes reconstructing a slice image of an object at a specified position on the Z-axis based on a plurality of projection views selected from respective ones of the sets of projection views, and the '712 Patent describes reconciling such axial positions at which projection views of a particular set represent an object with axial positions at which stacked slice images are to represent the object.

Accordingly, for at least the reasons set forth above, Claim 25 is submitted to be patentable over the '074 Patent in view of the '712 Patent.

Moreover, in contrast to the assertions in the Office Action, Applicants respectfully submit that it would not have been obvious to one skilled in the art to combine the teachings of the '712 Patent with the teachings of the '074 Patent to arrive at the present invention. More specifically, Applicants submit that the '074 Patent and the '712 Patent each teach away from the present invention. If art "teaches away" from a claimed invention, such a teaching supports the nonobviousness of the invention. U.S. v. Adams, 148 USPQ 479 (1966); Gillette Co. v. S.C. Johnson & Son, Inc., 16 USPQ2d 1923, 1927 (Fed. Cir. 1990). In light of this standard, it is respectfully submitted that the cited art, as a whole, is not suggestive of the presently claimed invention.

More specifically, the '074 Patent is directed to grouping projection views by view angle, and then using views from a plurality of the sets to reconstruct an image at a selected Z-location. More specifically, the '074 Patent recites, at col. 16, lines 51-57, that

> [a] notable point is that all of the projection views 1412 through 1438 represent the imaged heart in the same phase of the cardiac cycle. This is achieved by determining the sets of projection views from the raw data, *rather than selecting a specified axial position for the desired image* and then searching for suitable projection views in the raw data.

(Emphasis added.) Such a description in the '074 Patent teaches away from acquiring images at multiple z-locations $z_1 \ldots z_n$ and at different times $t_1 \ldots t_n$ at each of the z-locations to obtain a plurality of acquired image sets, each acquired image set including only the images acquired at a single one of the z-locations, as recited in the presently pending claims. As such, one of ordinary skill in the art would not look to the '074 Patent, which describes determining projection sets *rather than selecting an axial position*, to arrive at the presently pending claims, which are directed to obtaining a plurality of acquired image sets, wherein each acquired image set includes only the images acquired *at a single one of the z-locations*. (Emphasis added.)

Further, the '712 Patent is directed to re-ordering projection data by analyzing (3702) the data to determine a particular set of projection views at a selected view angle for each data acquisition cycle. More specifically, the '712 Patent recites, at col. 36, lines 23-28, that

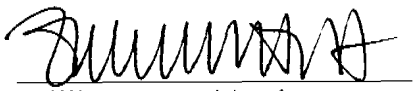
> [a] notable point is that all of the projection views 4112 through 4138 represent the imaged heart in the same phase of the cardiac cycle. This is achieved by determining the sets of projection views from the raw data, rather than selecting a specified axial position for the desired image and then searching for suitable projection views in the raw data.

(Emphasis added.) Such a description in the '712 Patent teaches away from acquiring images at multiple z-locations $z_1 \ldots z_n$ and at different times $t_1 \ldots t_n$ at each of the z-locations to obtain a plurality of acquired image sets, each acquired image set including only the images acquired at a single one of the z-locations, as recited in the presently pending claims. As such, one of ordinary skill in the art would not look to the '074 Patent, which describes determining projection sets *rather than selecting an axial position*, to arrive at the presently pending claims, which are directed to obtaining a plurality of acquired image sets, wherein each acquired image set includes only the images acquired *at a single one of the z-locations*. (Emphasis added.) Accordingly, Applicants respectfully submit that the cited art as a whole teaches away from the systems and methods for internal gating of the claimed invention, and for this reason alone, the Section 103 rejection of Claims 1-3, 15-17, and 19-25 be withdrawn.

For at least the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 1-3, 15-17, and 19-25 be withdrawn.

In view of the foregoing amendment and remarks, all the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action is respectfully solicited.

Respectfully submitted,



William J. Zychlewicz
Registration No. 51,366
ARMSTRONG TEASDALE LLP
One Metropolitan Square, Suite 2600
St. Louis, Missouri 63102-2740
(314) 621-5070